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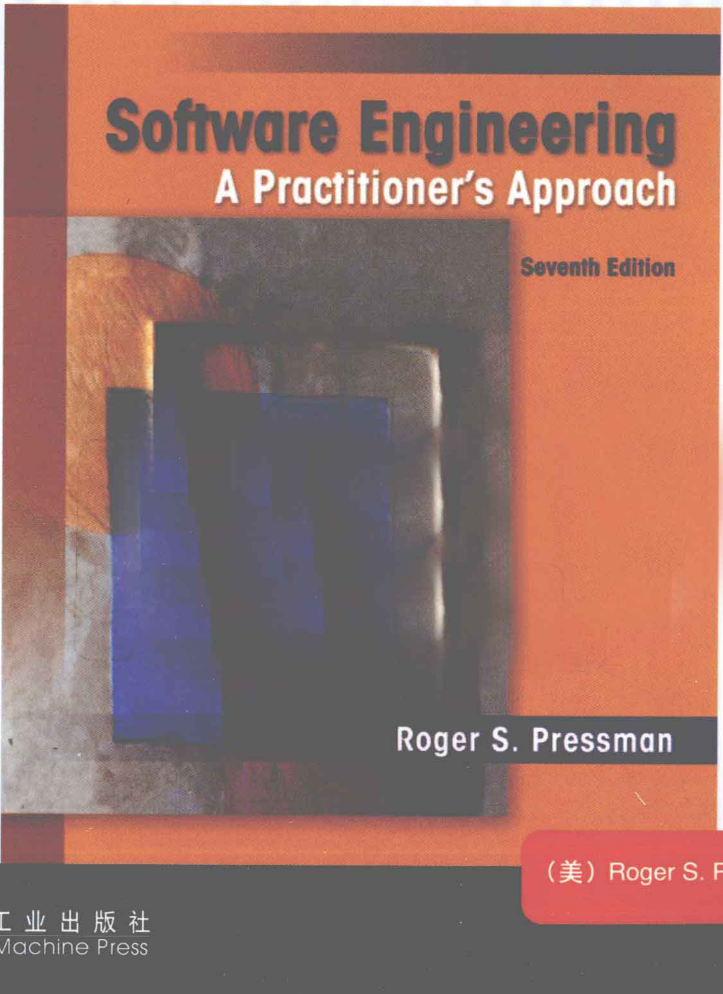
实践者的研究方法

（英文版 · 第7版）



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Software Engineering

A Practitioner's Approach

（美）Roger S. Pressman 著

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出版者的话

文艺复兴以降，源远流长的科学精神和逐步形成的学术规范，使西方国家在自然科学的各个领域取得了垄断性的优势；也正是这样的传统，使美国在信息技术发展的六十多年间名家辈出、独领风骚。在商业化的进程中，美国的产业界与教育界越来越紧密地结合，计算机学科中的许多泰山北斗同时身处科研和教学的最前线，由此而产生的经典科学著作，不仅擘划了研究的范畴，还揭示了学术的源变，既遵循学术规范，又自有学者个性，其价值并不会因年月的流逝而减退。

近年，在全球信息化大潮的推动下，我国的计算机产业发展迅猛，对专业人才的需求日益迫切。这对计算机教育界和出版界都既是机遇，也是挑战；而专业教材的建设在教育战略上显得举足轻重。在我国信息技术发展时间较短的现状下，美国等发达国家在其计算机科学发展的几十年间积淀和发展的经典教材仍有许多值得借鉴之处。因此，引进一批国外优秀计算机教材将对我国计算机教育事业的发展起到积极的推动作用，也是与世界接轨、建设真正的世界一流大学的必由之路。

机械工业出版社华章公司较早意识到“出版要为教育服务”。自1998年开始，我们就将工作重点放在了遴选、移译国外优秀教材上。经过多年的不懈努力，我们与Pearson，McGraw-Hill，Elsevier，MIT，John Wiley & Sons，Cengage等世界著名出版公司建立了良好的合作关系，从他们现有的数百种教材中甄选出Andrew S. Tanenbaum，Bjarne Stroustrup，Brain W. Kernighan，Dennis Ritchie，Jim Gray，Afred V. Aho，John E. Hopcroft，Jeffrey D. Ullman，Abraham Silberschatz，William Stallings，Donald E. Knuth，John L. Hennessy，Larry L. Peterson等大师名家的一批经典作品，以“计算机科学丛书”为总称出版，供读者学习、研究及珍藏。大理石纹理的封面，也正体现了这套丛书的品位和格调。

“计算机科学丛书”的出版工作得到了国内外学者的鼎力襄助，国内的专家不仅提供了中肯的选题指导，还不辞劳苦地担任了翻译和审校的工作；而原书的作者也相当关注其作品在中国的传播，有的还专程为

其书的中译本作序。迄今，“计算机科学丛书”已经出版了近两百个品种，这些书籍在读者中树立了良好的口碑，并被许多高校采用为正式教材和参考书籍。其影印版“经典原版书库”作为姊妹篇也被越来越多实施双语教学的学校所采用。

权威的作者、经典的教材、一流的译者、严格的审校、精细的编辑，这些因素使我们的图书有了质量的保证。随着计算机科学与技术专业学科建设的不断完善和教材改革的逐渐深化，教育界对国外计算机教材的需求和应用都将步入一个新的阶段，我们的目标是尽善尽美，而反馈的意见正是我们达到这一终极目标的重要帮助。华章公司欢迎老师和读者对我们的工作提出建议或给予指正，我们的联系方法如下：

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PREFACE

When computer software succeeds—when it meets the needs of the people who use it, when it performs flawlessly over a long period of time, when it is easy to modify and even easier to use—it can and does change things for the better. But when software fails—when its users are dissatisfied, when it is error prone, when it is difficult to change and even harder to use—bad things can and do happen. We all want to build software that makes things better, avoiding the bad things that lurk in the shadow of failed efforts. To succeed, we need discipline when software is designed and built. We need an engineering approach.

It has been almost three decades since the first edition of this book was written. During that time, software engineering has evolved from an obscure idea practiced by a relatively small number of zealots to a legitimate engineering discipline. Today, it is recognized as a subject worthy of serious research, conscientious study, and tumultuous debate. Throughout the industry, software engineer has replaced programmer as the job title of preference. Software process models, software engineering methods, and software tools have been adopted successfully across a broad spectrum of industry segments.

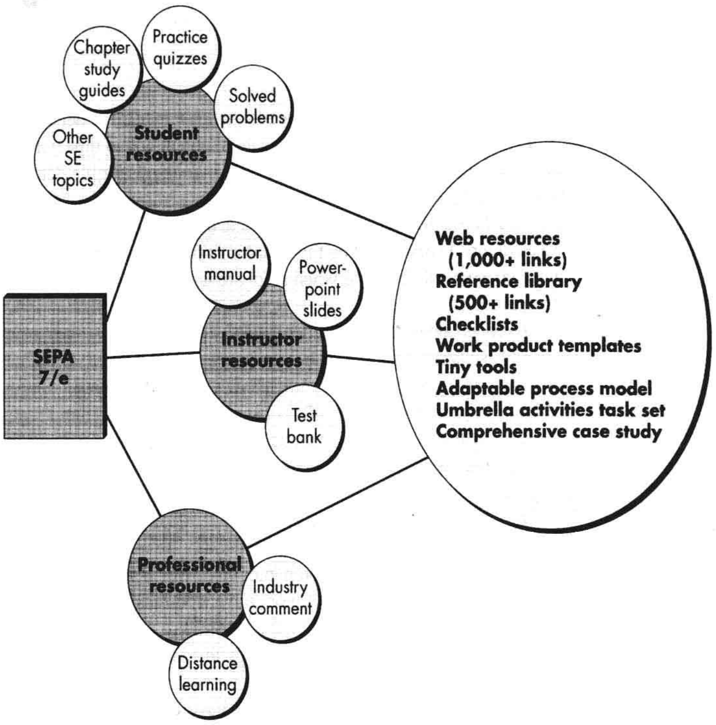
Although managers and practitioners alike recognize the need for a more disciplined approach to software, they continue to debate the manner in which discipline is to be applied. Many individuals and companies still develop software haphazardly, even as they build systems to service today's most advanced technologies. Many professionals and students are unaware of modern methods. And as a result, the quality of the software that we produce suffers, and bad things happen. In addition, debate and controversy about the true nature of the software engineering approach continue. The status of software engineering is a study in contrasts. Attitudes have changed, progress has been made, but much remains to be done before the discipline reaches full maturity.

The seventh edition of *Software Engineering: A Practitioner's Approach* is intended to serve as a guide to a maturing engineering discipline. Like the six editions that preceded it, the seventh edition is intended for both students and practitioners, retaining its appeal as a guide to the industry professional and a comprehensive introduction to the student at the upper-level undergraduate or first-year graduate level.

The seventh edition is considerably more than a simple update. The book has been revised and restructured to improve pedagogical flow and emphasize new and important software engineering processes and practices. In addition, a revised and updated "support system," illustrated in the figure, provides a comprehensive set of student, instructor, and professional resources to complement the content of the book. These resources are presented as part of a website (www.mhhe.com/ pressman) specifically designed for *Software Engineering: A Practitioner's Approach.*

The Seventh Edition. The 32 chapters of the seventh edition have been reorganized into five parts. This organization, which differs considerably from the sixth edition, has been done to better compartmentalize topics and assist instructors who may not have the time to complete the entire book in one term.

Support System for SEPA, 7/e



Part 1, *The Process,* presents a variety of different views of software process, considering all important process models and addressing the debate between prescriptive and agile process philosophies. Part 2, *Modeling,* presents analysis and design methods with an emphasis on object-oriented techniques and UML modeling. Pattern-based design and design for Web applications are also considered. Part 3, *Quality Management,* presents the concepts, procedures, techniques, and methods that enable a software team to assess software quality, review software engineering work products, conduct SQA procedures, and apply an effective testing strategy and tactics. In addition, formal modeling and verification methods are also considered. Part 4, *Managing Software Projects,* presents topics that are relevant to those who plan, manage, and control a software development project. Part 5, *Advanced Topics,* considers software process improvement and software engineering trends. Continuing in the tradition of past editions, a series of sidebars is used throughout the book to present the trials and tribulations of a (fictional) software team and to provide supplementary materials about methods and tools that are relevant to chapter topics. Two new appendices provide brief tutorials on UML and object-oriented thinking for those who may be unfamiliar with these important topics.

The five-part organization of the seventh edition enables an instructor to "cluster" topics based on available time and student need. An entire one-term course can be built around one or more of the five parts. A software engineering survey course would select chapters from all five parts. A software engineering course that emphasizes analysis and design would select topics from Parts 1 and 2. A testing-oriented software engineering course would select topics from Parts 1 and 3, with a brief foray into Part 2. A "management course" would stress Parts 1 and 4. By organizing the seventh edition in this way, I have attempted to provide an instructor with a number of teaching options. In every case, the content of the seventh edition is complemented by the following elements of the *SEPA, 7/e Support System*.

Student Resources. A wide variety of student resources includes an extensive online learning center encompassing chapter-by-chapter study guides, practice quizzes, problem solutions, and a variety of Web-based resources including software engineering checklists, an evolving collection of "tiny tools," a comprehensive case study, work product templates, and many other resources. In addition, over 1000 categorized *Web References* allow a student to explore software engineering in greater detail and a *Reference Library* with links to over 500 downloadable papers provides an in-depth source of advanced software engineering information.

Instructor Resources. A broad array of instructor resources has been developed to supplement the seventh edition. These include a complete online *Instructor's Guide* (also downloadable) and supplementary teaching materials including a complete set of over 700 *PowerPoint Slides* that may be used for lectures, and a test bank. Of course, all resources available for students (e.g., tiny tools, the Web References, the downloadable Reference Library) and professionals are also available.

The *Instructor's Guide for Software Engineering: A Practitioner's Approach* presents suggestions for conducting various types of software engineering courses, recommendations for a variety of software projects to be conducted in conjunction with a course, solutions to selected problems, and a number of useful teaching aids.

Professional Resources. A collection of resources available to industry practitioners (as well as students and faculty) includes outlines and samples of software engineering documents and other work products, a useful set of software engineering checklists, a catalog of software engineering (CASE) tools, a comprehensive collection of Web-based resources, and an "adaptable process model" that provides a detailed task breakdown of the software engineering process.

When coupled with its online support system, the seventh edition of *Software Engineering: A Practitioner's Approach,* provides flexibility and depth of content that cannot be achieved by a textbook alone.

Acknowledgments. My work on the seven editions of *Software Engineering: A Practitioner's Approach* has been the longest continuing technical project of my life. Even when the writing stops, information extracted from the technical literature continues to be assimilated and organized, and criticism and suggestions from readers worldwide is evaluated and cataloged. For this reason, my thanks to the many authors of books, papers, and articles (in both hardcopy and electronic media) who have provided me with additional insight, ideas, and commentary over nearly 30 years.

Special thanks go to Tim Lethbridge of the University of Ottawa, who assisted me in the development of UML and OCL examples and developed the case study that accompanies this book, and Dale Skrien of Colby College, who developed the UML tutorial in

Appendix 1. Their assistance and comments were invaluable. Special thanks also go to Bruce Maxim of the University of Michigan–Dearborn, who assisted me in developing much of the pedagogical website content that accompanies this book. Finally, I wish to thank the reviewers of the seventh edition: Their in-depth comments and thoughtful criticism have been invaluable.

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IIIT Hyderabad

The content of the seventh edition of *Software Engineering: A Practitioner's Approach* has been shaped by industry professionals, university professors, and students who have used earlier editions of the book and have taken the time to communicate their suggestions, criticisms, and ideas. My thanks to each of you. In addition, my personal thanks go to our many industry clients worldwide, who certainly have taught me as much or more than I could ever teach them.

As the editions of this book have evolved, my sons, Mathew and Michael, have grown from boys to men. Their maturity, character, and success in the real world have been an inspiration to me. Nothing has filled me with more pride. And finally, to Barbara, my love and thanks for tolerating the many, many hours in the office and encouraging still another edition of "the book."

Roger S. Pressman

About the Author

Roger S. Pressman is an internationally recognized authority in software process improvement and software engineering technologies. For almost four decades, he has worked as a software engineer, a manager, a professor, an author, and a consultant, focusing on software engineering issues.

As an industry practitioner and manager, Dr. Pressman worked on the development of CAD/CAM systems for advanced engineering and manufacturing applications. He has also held positions with responsibility for scientific and systems programming.

After receiving a Ph.D. in engineering from the University of Connecticut, Dr. Pressman moved to academia where he became Bullard Associate Professor of Computer Engineering at the University of Bridgeport and director of the university's Computer-Aided Design and Manufacturing Center.

Dr. Pressman is currently president of R.S. Pressman & Associates, Inc., a consulting firm specializing in software engineering methods and training. He serves as principal consultant and has designed and developed *Essential Software Engineering,* a complete video curriculum in software engineering, and *Process Advisor,* a self-directed system for software process improvement. Both products are used by thousands of companies worldwide. More recently, he has worked in collaboration with *EdistaLearning* in India to develop comprehensive Internet-based training in software engineering.

Dr. Pressman has written many technical papers, is a regular contributor to industry periodicals, and is author of seven technical books. In addition to *Software Engineering: A Practitioner's Approach,* he has co-authored *Web Engineering* (McGraw-Hill), one of the first books to apply a tailored set of software engineering principles and practices to the development of Web-based systems and applications. He has also written the award-winning *A Manager's Guide to Software Engineering* (McGraw-Hill); *Making Software Engineering Happen* (Prentice Hall), the first book to address the critical management problems associated with software process improvement; and *Software Shock* (Dorset House), a treatment that focuses on software and its impact on business and society. Dr. Pressman has been on the editorial boards of a number of industry journals, and for many years, was editor of the "Manager" column in *IEEE Software.*

Dr. Pressman is a well-known speaker, keynoting a number of major industry conferences. He is a member of the IEEE, and Tau Beta Pi, Phi Kappa Phi, Eta Kappa Nu, and Pi Tau Sigma.

On the personal side, Dr. Pressman lives in South Florida with his wife, Barbara. An athlete for most of his life, he remains a serious tennis player (NTRP 4.5) and a single-digit handicap golfer. In his spare time, he has written two novels, The *Aymara Bridge* and *The Puppeteer,* and plans to begin work on another.

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